DOCUMENT RESUME

ED 105 599 EA 007 022

AUTHOR	Pessemier, Edgar A.
TITLE	STRATOP: A Model for Designing Effective Product and Communication Strategies. Paper No. 470.
INSTITUTION	Purdue Univ., Lafayette, Ind. Herman C. Krannert Graduate School of Industrial Administration.
PUB DATE	Aug 74
NOTE	21p.
AVAILABLE FROM	Secretary of the Institute Paper Series, Krannert Graduate School of Industrial Administration, Purdue University, West Lafayette, Indiana 47907 (Paper No. 470, Free)
EDRS PRICE	MF-$0.76 HC-$1.58 PLUS POSTAGE
DESCRIPTORS	Change Strategies; Comparative Analysis; *Data Analysis; *Decision Making; Educational Alternatives; Information Processing; *Management Systems; *Mathematical Models; Models; *Planning

ABSTRACT

The STRATOP algorithm was developed to help planners and proponents find and test effectively designed choice objects and communication strategies. Choice objects can range from complex social, scientific, military, or educational alternatives to simple economic alternatives between assortments of branded convenience goods. Two classes of measured input data are used, one cognitive and the other affective. In addition, data on brand choice are needed to fit the parameters of the choice model. The STRATOP technique and the assorted preliminary analytical methods used modest amounts of standard data and yield very extensive findings, explicitly tailored to the needs of strategists and designers. Further experience is being accomulated with the expectation that the methods will find application in a number of areas involving significant social and economic choices among competing alternatives. (Author/JG)

STRATOP: A MODEL FOR DESIGNING EFFECTIVE PRODUCT AND COMMUNICATION STRATEGIES

by

Edgar A. Pessemier

Paper No. 470 - August 1974
(Short Version)

Institute for Research in the
BEHAVIORAL, ECONOMIC, and
MANAGEMENT SCIENCES

KRANNERT GRADUATE SCHOOL OF
INDUSTRIAL ADMINISTRATION

Purdue University
West Lafayette, Indiana

STRATOP: A Model for Designing Effective Product and Communication Strategies*

Edgar A. Pessemier

The discriminant analysis model has been adapted to serve as an alternative method for developing reduced-space configurations of choice objects. Related theory and applications are discussed by Pessemier and others in five related papers [8, 4, 6, 3, 7]. The first three papers cited deal with market segmentation and market structure. Large samples were used to obtain measures of brand preference and judgments about the level of each brand on a set of affectively determinant attributes. The preference measures provided a basis for market segmentation and served as input to the joint space analysis of each segment. The other input to the joint space was an orthogonalized discriminant configuration derived from attribute judgments. The structural coefficients of the configuration indicated the contribution of each attribute to consumers' perceptions of brand differences and their preferences for individual brands. In contrast to the three papers dealing with the large sample case, the last two papers cited above developed the theory and measurement methods for single-subject discriminant analysis and joint-space applications. One of these latter papers describes a limited test of the model and the other paper describes a number of methodological issues such as rotation of the space to aid interpretation. The latter paper also describes a useful model that predicts brand choice from ratio-scaled brand preference.

Building on the earlier work, the STRATOP algorithm was developed to aid planners and proponents find and test effectively designed choice objects and communication strategies. "Choice objects" can range from

*Paper presented at the National American Institute of Decision Sciences meeting, Atlanta, Georgia, November, 1974. Do not reproduce without the author's permission.

complex alternatives found in the fields of social, scientific, military or educational decision-making to simple economic alternatives found in assortments of branded convenience goods. In this paper, attention will be devoted to the objects of market choice that are subject to a firm's design and communication decisions. This degree of specificity should not detract from the reader's appreciation of the model's broad applicability.

THE MODEL

In the market context, the STRATOP model predicts the effect on brand sales and profits of changes in a product's design and/or its supporting sales and advertising programs. In accomplishing this purpose, STRATOP exploits the properties of the Phase 2 and 3 ideal-point forms of the PREFMAP joint-space model [2]. The metric version of the latter model can accept ratio-scaled brand preference and an attribute-based, orthogonalized discriminant configuration of brands.

The measurement variables and data reduction required prior to employ. the strategy testing and finding features of STRATOP deserve attention. Two classes of measured input data are used, one cognitive and the other affective. In the notation employed here,

x_{ijk} = subject i's rating of brand k on <u>affectively determinant</u> attribute j.

$\hat{x}_{ik}$ = subject i's ratio-scaled preference for brand k. These data are typically derived from adjusted constant sum or graded paired preference judgments.

Markets can be segmented on the basis of these or other variables. Experience indicates that one productive approach is to group buyer or consumers into M market segments on the basis of their brand preferences and assign each segment a common preference profile, $\hat{\underline{x}}_m$. These segments

may also be used to develop segment-specific brand configurations. Although this secondary cognitive segmentation is called for in some cases [6], purely affective segments will be the only type considered in this discussion.

In addition to the cognitive and affective measures, data on brand choice probabilities or the relative frequency of choice are needed to fit the β parameter of the choice model in (1). Several different data collection strategies could be used in parameter fitting. For simplicity, assume relative frequency of choice data have been collected from the same subjects who provided the requisite cognitive and affective data. If p_{mk} is the relative frequency with which subjects in preference segment m chose brand k, then,

$$\hat{p}_{mk} = \hat{x}_{mk}^{\hat{\beta}} \Big/ \Sigma_{k=1}^{K} \hat{x}_{mk}^{\hat{\beta}}. \tag{1}$$

This model has been successfully employed by Pessemier and others in a marketing context [10, 1]. Its relation to Luce's Choice Theorem and Steven's Power Law has been noted [9] and Nakaniski has shown that β can be estimated by regression methods [5]. For a designated segment and all brands, the linear model is

$$\ln(p/p^{\circ}) = \beta \ln(\hat{x}/\hat{x}^{\circ}) + e \tag{2}$$

where $^{\circ}$ indicates the geometric mean over k.

The required attribute data can be processed by CONFANA, a discriminant analysis routine with added features for configural manipulation and analysis. In the derived P dimensional reduced-space, brand k's centroid location is a linear function of the J element column vector of mean attribute ratings for the brand, $\underline{x}_k$. The coefficients of the function can be found in the JxP matrix of discriminant functions, $\underline{V}$. The full PxK matrix of brand centroid locations in discriminant space, $\underline{Q} = \underline{V}'\underline{\bar{X}}$, is

orthogonalized, along with the associated $\underline{V}$ and $\underline{S}$ matrices. Call the results $\underline{Q}^*$, $\underline{V}^*$ and $\underline{S}^*$. Then $\underline{S}^*$, the matrix of discriminant structure coefficients, is Varimax rotated to simple structure and the same rigid transformation is applied to $\underline{Q}^*$ and $\underline{V}^*$. The new orthogonalized and rotated matrices are $\underline{Q}^{**}$, $\underline{V}^{**}$ and $\underline{S}^{**}$. The coefficients in $\underline{S}^{**}$ are used to analyze the contribution of attributes to the formation of the cognitive space. $\underline{Q}^{**}$ is the configuration of brands used in PREFMAP. The $\underline{V}^{**}$ and $\underline{\bar{X}}$ matrices are passed to STRATOP for testing and optimizing the design of strategy alternatives. For simplicity the ** superscripts will be dropped in the following discussion.

The analysis phases of the PREFMAP joint-space model are designated by g and the stage or iterative step in any testing or optimization procedure is designated by h. The initial condition is h=1. The Phase 2 and 3 models fit squared distance from an ideal/anti-ideal point for each segment to each brand. These squared distances are linearly related to the brand affective scale values, $\hat{x}_{mk}$. The estimated affective scales, $\hat{x}(g,h)_{mk}$, developed by STRATOP are least squares fits to the ratio-scaled affective input, $\hat{x}_{mk}$. The parameters of the linear model for each segment m in Phase g analysis are $\hat{\alpha}_o(g)_m$ and $\hat{\alpha}_1(g)_m$. They are estimated by regressing the brand ideal-point distances on the brand affective scales,

$$\hat{x}_{mk} = \alpha_o(g)_m + \alpha_1(g,)_m \, d^2(g,1)_{mk} + e_{mk}. \tag{3}$$

In turn, the estimated affective value of a brand to a segment at any stage h of the STRATOP analysis can be computed from

$$\hat{x}(g,h)_{mk} = \hat{\alpha}_o(g)_m + \hat{\alpha}_1(g)_m \, d^2(g,h)_{mk} \tag{4}$$

These estimated affective scale values can be substituted in (1) to estimate the probability of purchase,

$$\hat{p}_{mk} = \hat{x}(g,h)^{\beta}_{mk} \Big/ \sum_{k=1}^{K} \hat{x}(g,h)^{\beta}_{mk}. \tag{5}$$

The output of PREFMAP includes the original input configuration, $\underline{Q}$, a vector of ideal point coordinates for each segment, $\underline{\rho(g)_m}$, and the reduced-space salience weights $\underline{w(1)_m}$ or $\underline{u(1)_m}$, and the linear parameters $\hat{\alpha}_o(g)_m$ and $\hat{\alpha}_1(g)_m$. The appropriate affective distance in joint-space associated with a brand location $\rho(g,h)_{kp}$ and a market segment's ideal point, $\rho(g,h)_{mk}$, can be computed from

$$d^2(2,h)_{m,k} = \Sigma_{p=1}^{P} w(h)_{mp} [q(h)_{kp} - \rho(h)_{mp}]^2 \qquad (6a)$$

or

$$d^2(3,h)_{m,k} = \Sigma_{p=1}^{P} u(h)_{mp} [q(h)_{kp} - \rho(h)_{mp}]^2 \qquad (6b)$$

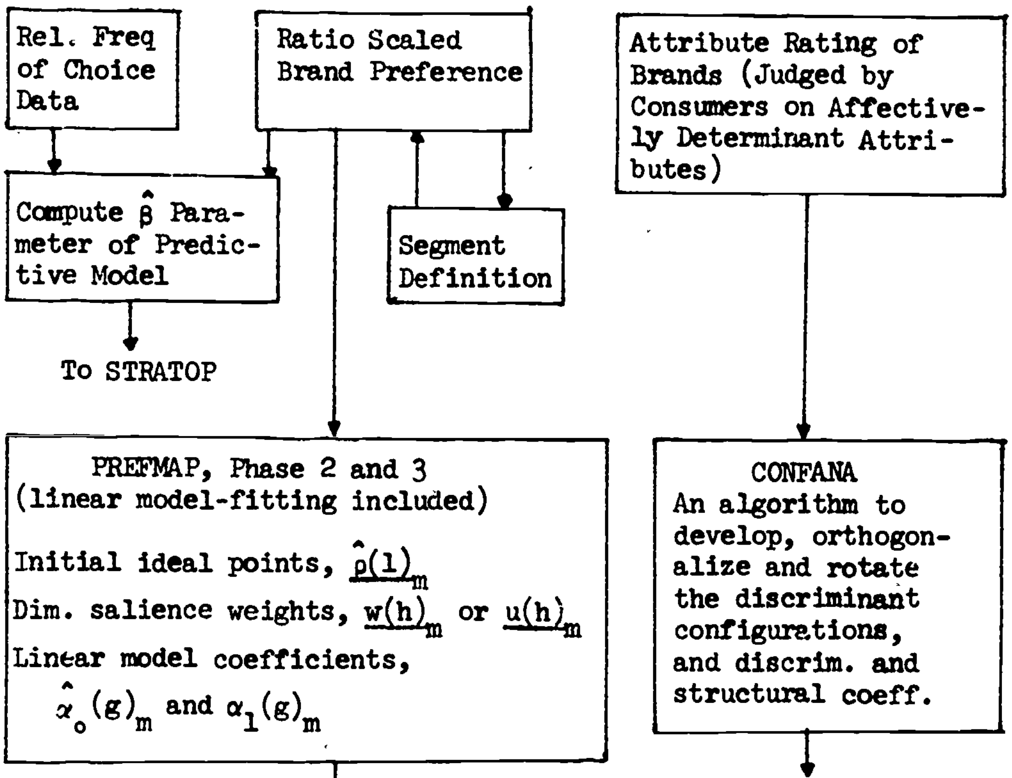
The same formulas can be used to recompute affective distance following the move of a brand or ideal point. The expected effect on choice is examined with the aid of equations (4) and (5).

The initial PREFMAP procedure and the data used for subsequent analysis are outlined in the top of Figure 1. The lower part of Figure 1 outlines the STRATOP analyses. The central features of the algorithm are briefly described below. In testing fixed or prespecified alternative strategies and in searching for improved strategies dealing with the location of a brand, ideal point or the size of an attribute salience weight, all relevant purchase probabilities are computed with the aid of equations (4) - (6). With the aid of standard accounting estimates related to revenues and costs, the expected profit implied by these probabilities are also computed. The cost of a product is $\underline{cx(h)_k}$, where $\underline{c}$ is the vector of costs per unit of each attribute and $\underline{x(h)_k}$ is the vector of attribute units in design h of product k.

A strategist may have a number of specific alternatives open when considering design and communication strategies. The more significant options

FIGURE 1

Preliminary Analysis



STRATOP

[1] For initial input, compute $d^2(g,h)_{mk}$, $\hat{x}(g,h)_{mk}$ and $\hat{p}_{mk}$ and for all relevant cases compute expected brand unit sales, sale revenue and profits.

[2] Analyze all prespecified design, product and communication strategies. See text strategy types (1), (2), (3), (4), (5), and (6).

[3] For each location in a grid of brand locations about $\underline{g(1)}$, find the most profitable position and design.

[4] For a grid of ideal-point locations about $\underline{\rho(1)}_m$, for all M examine the revenue effects.

[5] For a grid of salience weight about $\underline{w(1)}_m$ and/or $\underline{u(1)}_m$, examine the revenue effects.

include:

1) A firm's or its competitor's brands may not be accurately perceived. A communication effort may correct the "errors" in brand perception by moving the brand(s) initial location, $\underline{q(1)}_k$, to a new point in space, $\underline{q(h)}_k$. Product designs remain unchanged but the effect of the communications on purchase behavior and profit must be appraised.
2) A specific design change h may be considered which will shift the location of brand k to a new estimated location $\underline{q(h)}_k$ and impose a new unit cost $\underline{cx(h)}_k$.
3) A void exists in the product space in the neighborhood of a point $\underline{q(1)}_{k'}$. The revenue effect of introducing a new product k' of unspecified design can be investigated. Alternatively, the profit effect of introducing a new fixed design, k", into the product space at an estimated location $\underline{q(1)}_{k''}$ may be of interest. Finally, the effect on profit of deleting a product currently at $\underline{q(1)}_k$ may be examined.
4) A strategist may want to know if the design components of product, $\underline{x(h)}_k$, can be changed to reduce the total cost of k without changing the brand's position in reduced space, $\underline{q(1)}_k$. In this case, a cost minimizing linear programming problem with (P + 2J) constraints must be solved for each $\underline{q(h)}_k$ location of interest. Fortunately, the basic solution at one stage of the design-improvement process can often be used to compute a solution at the next stage.
5) How segments appraise the importance of reduced-space attributes may work to the disadvantage of a brand, i.e. the brand may be the safest product but consumers are giving little weight to product safety. In this case, the effect of increasing the salience weighting

of safety at some communications cost becomes the subject of study.

6) The ideal level of product attributes sought by consumers may be dysfunctional, i.e. consumers want too much power or excessive levels of durability. In this case, an analyst may want to study the effect of a communication expenditure designed to relocate one or more market segment's ideal points.

In all of the above strategy testing approaches, the objective functions for a design or communication strategy h include the expected unit sales of all brands, the expected profit from the specific brand(s) of interest and the design profiles produced by cost-minimizing redesign program.

In the "optimizing" segment of STRATOP that does not employ prespecified alternative, see [3] - [5] in Figure 1, three types of search and/or optimizing are feasible. In the first case, a brand is moved plus and minus a specified increment on a dimension and its design is optimized (the cost minimized) at each new point. The brand movement is repeated for all reduced space dimensions. In the second case, ideal points are moved an increment on each dimension for all reduced space dimensions. In the third case, the salience weights for each dimension is changed by a percentage increment for all reduced space dimensions. In all three search and/or optimization runs, the objective is to <u>locate</u> efficient strategies for repositioning a brand's or modifying segment's utility function.

CONCLUSION

It is noteworthy that the STRATOP technique and the associated preliminary analytical methods use modest amounts of standard data and yield very extensive findings explicitly tailored to the needs of strategists and designers. Furthermore, the economics of the problem are always examined

in connection with the design and communication alternatives. The full set of procedures is too new to have faced the test of extensive applications. However, most of the programs have successfully run on large and realistic test problems. Further experience is being accumulated with the expectation that the methods will find application in a number of areas involving significant social and economic choices among competing alternatives.

References

[1] Bass, Frank M., Edgar A. Pessemier and Donald R. Lehmann, "An Experimental Study of Relationships Between Attitudes, Brand Preference and Choice," Behavioral Science, November 1972, pp. 532-541.

[2] Carroll, J. Douglas, "Individual Differences and Multidimensional Scaling," in Roger Shepard, A. Kimball Romney and Sara Beth Nerlove, Ed., Multidimensional Scaling: Theory and Application in the Behavioral Sciences, Vol. 1, Seminar Press, Inc., New York, 1972, pp. 105-155.

[3] Jones, Wesley H. and Edgar A. Pessemier, "Single Subject Discriminant Configurations: An Examination of Reliability, Validity and Joint-space Implications," Institute Paper No. 451, Krannert Graduate School of Industrial Administration, Purdue University, March 1974.

[4] Lehmann, Donald R. and Edgar A. Pessemier, "Market Structure Modeling Via Clustering and Discriminant Analysis: A Portrayal of the Soft Drink Market," Institute Paper No. 407, Krannert Graduate School of Industrial Administration, Purdue University, April 1973.

[5] Nakanishi, Masao, "Measurement of Sales Promotion Effects at the Retail Level - A New Approach," in Boris W. Becker and Helmut Becker, Ed., Combined Proceedings of the American Marketing Association, 1972, pp. 338-343.

[6] Pessemier, Edgar A. and James L. Ginter, "Analysis of Brand Preference Segments," (Rev.) Institute Paper No. 409, Krannert Graduate School of Industrial Administration, Purdue University, April 1974.

[7] Pessemier, Edgar A. and Wesley H. Jones, "Joint-space Analysis of the Structure of Affect Using Single-Subject Discriminant Configurations, Part I," Institute Paper No. 435, Krannert Graduate School of Industrial Administration, Purdue University, February 1974.

[8] Pessemier, Edgar A. and H. Paul Root, "Dimensions of New Product Planning," Journal of Marketing, January 1973, pp. 10-18.

[9] Pessemier, Edgar A. and William L. Wilkie, "Multi-attribute Choice Theory - A Review and Analysis," Institute Paper No. 372, Krannert Graduate School of Industrial Administration, Purdue University, September 1972.

[10] Pessemier, Edgar A., Philip C. Burger, Richard D. Teach and Douglas J. Tigert, "Using Laboratory Brand Preference Scales to Predict Consumer Brand Choice," Management Science, 1971, 6, pp. 371-385.

INSTITUTE PAPERS

The following is a listing of Institute Papers which are still in supply. Copies may be obtained from the Secretary of the Institute Paper Series, Krannert Graduate School of Industrial Administration, Purdue University, West Lafayette, Indiana 47907.

When requesting copies, please specify paper number. NOTE: Distribution limited to ten (10) items.

Paper No.	Title and Author(s)
101	Keith V. Smith, CLASSIFICATION OF INVESTMENT SECURITIES USING MULTIPLE DISCRIMINANT ANALYSIS.
161	James M. Holmes, THE PURCHASING POWER PARITY THEORY: IN DEFENSE OF GUSTAV CASSEL AS A MODERN THEORIST.
162	John Dutton and William Starbuck, HOW CHARLIE ESTIMATES RUN-TIME.
187	Robert V. Horton, A SUGGESTED NEW MONETARY SYSTEM: THE GOLD VALUE STANDARD.
189	John J. Sherwood and Mark Nataupsky, PREDICTING THE CONCLUSIONS OF NEGRO-WHITE INTELLIGENCE RESEARCH FROM BIOGRAPHICAL CHARACTERISTICS OF THE INVESTIGATOR.
226	Edward Ames, THE FIRM AS AN AUTOMATION.
242	Keith C. Brown, ESTIMATING FREQUENCY FUNCTIONS FROM LIMITED DATA.
243	John O. Summers and Charles W. King, OPINION LEADERSHIP AND NEW PRODUCT ADOPTION.
265	Frank M. Bass, APPLICATION OF REGRESSION MODELS IN MARKETING: TESTING VERSUS FORECASTING.
268	James C. Moore, ON PARETO OPTIMA AND COMPETITIVE EQUILIBRIA, PART I. RELATIONSHIP AMONG EQUILIBRIA AND OPTIMA.
269	James C. Moore, ON PARETO OPTIMA AND COMPETITIVE EQUILIBRIA, PART II. THE EXISTENCE OF EQUILIBRIA AND OPTIMA.
275	Patric H. Hendershott, THE FULL-EMPLOYMENT INTEREST RATE AND THE NEUTRALIZED MONEY STOCK.
282	E. A. Pessemier & R. D. Teach, DISAGGREGATION OF ANALYSIS OF VARIANCE FOR PAIRED COMPARISONS: AN APPLICATION TO A MARKETING EXPERIMENT.

283 John V. Nevers, MARKET RESPONSE TO INNOVATION, FURTHER APPLICATIONS OF THE BASS NEW PRODUCT GROWTH MODEL.

284 James A. Craft, PROFESSIONALISM, UNIONISM, AND COLLECTIVE NEGOTIATION: TEACHER NEGOTIATIONS EXPERIENCE IN CALIFORNIA.

285 Thomas F. Cargill and Robert A. Meyer, A FREQUENCY DOMAIN TEST OF THE DISTURBANCE TERM IN LINEAR REGRESSION MODELS.

286 Edgar A. Pessemier, EVALUATING ALTERNATIVE PROPOSALS AND SOURCES OF NEW INFORMATION.

287 Frank M. Bass and Neil E. Beckwith, A MULTIVARIATE REGRESSION ANALYSIS OF THE RESPONSES OF COMPETING BRANDS TO ADVERTISING.

288 Keith C. Brown, ASSESSING REGULATORY ALTERNATIVES FOR THE NATURAL GAS PRODUCING INDUSTRY.

289 D. Clay Whybark, TESTING AN ADAPTIVE INVENTORY CONTROL MODEL.

291 William K. Holstein and William L. Berry, THE LABOR ASSIGNMENT DECISION: AN APPLICATION OF WORK FLOW STRUCTURE INFORMATION.

295 Robert C. Cummins and Donald C. King, THE INTERACTION OF GROUP SIZE AND TASK STRUCTURE IN AN INDUSTRIAL ORGANIZATION.

296 Edgar A. Pessemier and Norman R. Baker, PROJECT AND PROGRAM DECISIONS IN RESEARCH AND DEVELOPMENT.

297 Edgar A. Pessemier, DATA QUALITY IN MARKETING INFORMATION SYSTEMS.

298 Edgar A. Pessemier and Thomas Hustad, SEGMENTING CONSUMER MARKETS WITH ACTIVITY AND ATTITUDE MEASURES.

300 Charles A. Tritschler, DILUTION AND COUNTER-DILUTION IN REPORTING FOR DEFERRED EQUITY.

303 K. R. Kadiyala, ON PRODUCTION FUNCTIONS AND ELASTICITY OF SUBSTITUTION.

305 Akira Takayama, A NOTE ON MONEY AND GROWTH.

309 Paul V. Johnson, WAGES AND HOURS AS SIGNIFICANT ISSUES IN COLLECTIVE BARGAINING.

311 Basheer M. Khumawala, AN EFFICIENT HEURISTIC ALGORITHM FOR THE WARE-HOUSE LOCATION PROBLEM.

312 M. H. Rucker and D. C. King, REACTIONS TO LEADERSHIP STYLE AS A FUNCTION OF PERSONALITY VARIABLES.

314 Frank M. Bass and Darrall G. Clarke, TESTING DISTRIBUTED LAG MODELS OF ADVERTISING EFFECT - AN ANALYSIS OF DIETARY WEIGHT CONTROL PRODUCT DATA.

317 Mohamed El-Hodiri and Akira Takayama, BEHAVIOR OF THE FIRM UNDER REGULATORY CONSTRAINT: CLARIFICATIONS.

328 Patric H. Hendershott, THE EXPECTED RATE OF INFLATION BEFORE AND AFTER 1966: A CRITIQUE OF THE ANDERSEN-CARLSON EQUATION.

332 Russell M. Barefield and Eugene E. Comiskey, THE SMOOTHING HYPOTHESIS: AN ALTERNATIVE TEST.

333 Herbert Moskowitz, CONSERVATISM IN GROUP INFORMATION PROCESSING BEHAVIOR UNDER VARYING MANAGEMENT INFORMATION SYSTEMS.

334 Herbert Moskowitz, PRIMACY EFFECTS IN INFORMATION PROCESSING BEHAVIOR - THE INDIVIDUAL VERSUS THE GROUP.

339 Frank M. Bass, UNEXPLAINED VARIANCE IN STUDIES OF CONSUMER BEHAVIOR.

340 R. C. Roistacher and John J. Sherwood, THE PRODUCTION FUNCTION AS A MODEL OF THE REQUIREMENTS OF THE INFANTRY SERGEANT'S ROLE.

341 William L. Berry and F. W. Bliemel, SELECTING EXPONENTIAL SMOOTHING MODEL PARAMETERS: AN APPLICATION OF PATTERN SEARCH.

344 H. L. Fromkin, R. L. Dipboye and Marilyn Pyle, REVERSAL OF THE ATTITUDE SIMILARITY-ATTRACTION EFFECT BY UNIQUENESS DEPRIVATION.

347 Hérbert Moskowitz, THE VALUE OF INFORMATION IN AGGREGATE PRODUCTION PLANNING - A BEHAVIORAL EXPERIMENT.

348 Edgar A. Pessemier, A MEASUREMENT AND COMPOSITION MODEL FOR INDIVIDUAL CHOICE AMONG SOCIAL ALTERNATIVES.

349 Akira Takayama. THE NEOCLASSICAL THEORY OF INVESTMENT AND ADJUSTMENT COSTS.

350 D. Clay Whybark and Basheer M. Khumawala, A SURVEY OF FACILITY LOCATION METHODS.

351 Martin Patchen, THE LOCUS AND BASIS OF INFLUENCE ON ORGANIZATION DECISIONS.

352 Robert V. Horton, A PLEA FOR A FOURTH TRADITION - AND FOR ECONOMICS.

354 Robert V. Horton, STUDENT APPLICATIONS IN A PRINCIPLES COURSE OF ECONOMIC ANALYSIS TO SELF-DISCOVERED ITEMS.

355 Basheer M. Khumawala, BRANCH AND BOUND ALGORITHMS FOR LOCATING EMERGENCY SERVICE FACILITIES.

357 Basheer M. Khumawala, AN EFFICIENT ALGORITHM FOR CENTRAL FACILITIES LOCATION.

358 James L. Ginter and Frank M. Bass, AN EXPERIMENTAL STUDY OF ATTITUDE CHANGE, ADVERTISING AND USAGE IN NEW PRODUCT INTRODUCTION.

360 B. M. Khumawala and D. L. Kelly, WAREHOUSE LOCATION WITH CONCAVE COSTS.

362 Antal Majthay and Andrew Whinston, QUASI-CONCAVE MINIMIZATION SUBJECT TO LINEAR CONSTRAINTS.

366 Howard L. Fromkin, A SOCIAL PSYCHOLOGICAL ANALYSIS OF ORGANIZATION INTEGRATION.

367 J. R. Marsden, D. E. Pingry and A. Whinston, ECONOMICS OF WASTE-WATER TREATMENT: THE ROLE OF REGRESSION.

368 Edgar A. Pessemier and H. Paul Root, THE ROLE OF MODELS IN NEW PRODUCT PLANNING.

370 James C. Moore, AXIOMATIC CHARACTERIZATIONS OF CONSUMER PREFERENCES AND THE STRUCTURE OF THE CONSUMPTION SET.

371 Dan E. Schendel and Kenneth J. Hatten, BUSINESS POLICY OR STRATEGIC MANAGEMENT: A BROADER VIEW FOR AN EMERGING DISCIPLINE.

372 Edgar A. Pessemier and William L. Wilkie, MULTI-ATTRIBUTE CHOICE THEORY - A REVIEW AND ANALYSIS.

373 Herbert Moskowitz and J. G. Miller, INFORMATION AND DECISION SYSTEMS FOR PRODUCTION PLANNING: AN INTER-DISCIPLINARY PERSPECTIVE.

375 Randall L. Schultz, A COMPETITIVE PARITY APPROACH TO COMPETITION IN A DYNAMIC MARKET MODEL.

378 Basheer M. Khumawala and David G. Dannenbring, AN IMPROVED METHOD FOR THE SEGREGATED STORAGE PROBLEM.

379 Keith C. Brown, ON THE PROBABILITY OF WINNING IN A COMPETITIVE BIDDING THEORY.

381 E. E. Adam, Jr., W. L. Berry and D. C. Whybark, FORECASTING DEMAND FOR MEDICAL SUPPLY ITEMS USING EXPONENTIAL AND ADAPTIVE SMOOTHING MODELS.

383 John Z. Drabicki and Akira Takayama, ON THE OPTIMAL GROWTH OF THE TWO SECTOR ECONOMY.

384 Keith C. Brown, UNCERTAIN COSTS IN COMPETITIVE BIDDING.

388 James C. Moore, PROFESSOR DEBREU'S "MARKET EQUILIBRIUM" THEOREM: AN EXPOSITORY NOTE.

389 Jeffrey G. Miller and William L. Berry, THE ASSIGNMENT OF MEN TO MACHINES: AN APPLICATION OF BRANCH AND BOUND.

390 David L. Ford, Jr., THE IMPACT OF HIERARCHY AND GROUP STRUCTURE ON INFORMATION PROCESSING IN DECISION MAKING: APPLICATION OF A NETWORKS/ SYSTEMS APPROACH.

391 J. F. Nunamaker, Jr., W. C. Nylin, Jr. and Benn Konsynski, PROCESSING SYSTEMS OPTIMIZATION THROUGH AUTOMATIC DESIGN AND REORGANIZATION OF PROGRAM MODULES.

392 J. F. Nunamaker, Jr., D. E. Swenson and A. B. Whinston, GPLAN: A GENERALIZED DATA BASE PLANNING SYSTEM.

393 Robert A. Meyer, Jr., SOME ASPECTS OF THE COMPUTATION AND APPLICATION OF FREQUENCY DOMAIN REGRESSION IN ECONOMICS.

394 Herbert Moskowitz, EFFECTS OF PROBLEM REPRESENTATION AND FEEDBACK ON RATIONAL BEHAVIOR IN ALIAIS AND MORIAT-TYPE PROBLEMS.

395 Herbert Moskowitz, A DYNAMIC PROGRAMMING APPROACH FOR FINDING PURE ADMISSIBLE DECISION FUNCTIONS IN STATISTICAL DECISIONS.

396 James Marsden, David Pingry and Andrew Whinston, ENGINEERING FOUNDATIONS OF PRODUCTION FUNCTIONS.

397 Herbert Moskowitz and Willibrord T. Silva, EFFECT OF SOCIAL INTERACTION ON HUMAN PROBABILISTIC INFERENCE.

398 Frank M. Bass and William L. Wilkie, A COMPARATIVE ANALYSIS OF ATTITUDINAL PREDICTIONS OF BRAND PREFERENCE.

399 Charles A. Tritschler, THE FINANCING - INVESTMENT FUNDS FLOW.

400 David L. Ford, Jr., Larry L. Cummings and George P. Huber, THE EFFECTS OF STRUCTURE ON GROUP EFFICIENCY AND INTERJUDGE AGREEMENT FOLLOWING GROUP DISCUSSIONS.

402 Edna T. Loehman and Andrew Whinston, FINANCIAL CONSTRAINTS ON REGULATED INDUSTRIES.

403 William L. Berry and Jeffrey G. Miller, HEURISTIC METHODS FOR ASSIGNMENT MEN TO MACHINES, AN EXPERIMENTAL ANALYSIS.

404 David G. Olson and Gordon P. Wright, MODELS FOR ALLOCATING POLICE PREVENTIVE PATROL EFFORT.

406 Edgar A. Pessemier, SINGLE SUBJECT DISCRIMINANT CONFIGURATIONS.

407 Donald R. Lehmann and Edgar A. Pessemier, MARKET STRUCTURE MODELING VIA CLUSTERING AND DISCRIMINANT ANALYSIS: A PORTRAYAL OF THE SOFT DRINK MARKET.

409 Edgar A. Pessemier and James L. Ginter, PROFILES OF MARKET SEGMENTS AND PRODUCT COMPETITIVE STRUCTURES.

410 Darral G. Clarke and John M. McCann, MEASURING THE CUMULATIVE EFFECTS OF ADVERTISING: A REAPPRAISAL.

411 Akira Takayama, ON BIASED TECHNOLOGICAL PROGRESS.

412 William L. Wilkie, RESEARCH ON COUNTER AND CORRECTIVE ADVERTISING.

413 Akira Takayama, ON THE ANALYTICAL FRAMEWORK OF TARIFFS & TRADE POLICY.

414 K. R. Kadiyala and K.S.R. Murthy, ESTIMATION OF REGRESSION EQUATION WITH CAUCHY DISTURBANCES.

415 Frank M. Bass, A REVISED VERSION OF THE THEORY OF STOCHASTIC PREFERENCE AND BRAND SWITCHING.

416 Jo Ann J. Chanoux, ANALYSIS OF TIME-SHARING CONTRACT AGREEMENTS WITH RELATED SUGGESTED SYSTEMS EVALUATION CRITERIA.

417 Herbert Moskowitz and John Hughes, THE DESCRIPTIVE VALIDITY OF THE STATIONARITY ASSUMPTION IN TIME DISCOUNTING: AN EXPLORATORY STUDY.

418 Robert V. Horton, A RESOURCE MARKET ENIGMA IN PRINCIPLES COURSES - SOME UNCHARTED LINKAGES.

419 Dick R. Wittink, PARTIAL POOLING: A HEURISTIC.

420 Randall L. Schultz and Joe A. Dodson, Jr., AN EMPIRICAL-SIMULATION APPROACH TO COMPETITION.

421 Howard L. Fromkin and Timothy C. Brock, EROTIC MATERIALS: A COMMODITY THEORY ANALYSIS OF THE ENHANCED DESIRABILITY WHICH MAY ACCOMPANY THEIR UNAVAILABILITY.

422 Albert R. Wildt and Frank M. Bass, MULTIFIRM ANALYSIS OF COMPETITIVE DECISION VARIABLES.

423 Russell M. Barefield and Eugene E. Comiskey, EARNINGS VARIABILITY AS A RISK SURROGATE.

424 Frank M. Bass, MARKET STRUCTURE AND PROFITABILITY - ANALYSIS OF THE APPROPRIATENESS OF POOLING CROSS-SECTIONAL INDUSTRY DATA.

425 Charles W. King and George B. Sproles, THE EXPLANATORY EFFICACY OF SELECTED TYPES OF CONSUMER PROFILE VARIABLES IN FASHION CHANGE AGENT IDENTIFICATION.

426 Paul M. Nemiroff, GROUP DECISION-MAKING PERFORMANCE AS INFLUENCED BY CONSENSUS AND SELF-ORIENTATION.

427 Herbert Moskowitz, AN ALGORITHM FOR DETERMINING BAYESIAN ATTRIBUTE SINGLE SAMPLING ACCEPTANCE PLANS.

428 Herbert Moskowitz, SOME OBSERVATIONS ON THEORIES OF COLLECTIVE DECISIONS.

429 Herbert Moskowitz and W. Murnighan, CENTRALIZATION VERSUS DECENTRALIZATION VIA REPORTS OF EXCEPTIONS: DESCRIPTIVE VERSUS NORMATIVE BEHAVIOR IN A SIMULATED FINANCIAL ORGANIZATION.

430 Kent Wiback, Robert L. Dipboye and Howard L. Fromkin, EXPERIMENTAL STUDIES OF DISCRIMINATION IN THE EVALUATION OF JOB APPLICANTS' RESUMES: I. RELATIVE IMPORTANCE OF SEX, ATTRACTIVENESS, AND SCHOLASTIC STANDING.

431 A. Cooper, E. Demuzzio, K. Hatten, E. Hicks and D. Tock, STRATEGIC RESPONSES TO TECHNOLOGICAL THREATS.

432 Robert O. Edmister, COMMERCIAL LOANS AND DEPOSITS OF LARGE COMMERCIAL BANKS.

433 George B. Sproles and Charles W. King, THE CONSUMER FASHION CHANGE AGENT: A THEORETICAL CONCEPTUALIZATION AND EMPIRICAL IDENTIFICATION.

434 W. L. Berry and D. Clay Whybark, RESEARCH PERSPECTIVES FOR MATERIAL REQUIREMENTS PLANNING SYSTEMS.

435 Edgar A. Pessemier, JOINT-SPACE ANALYSIS OF THE STRUCTURE OF AFFECT USING SINGLE-SUBJECT DISCRIMINANT CONFIGURATIONS: PART I.

436 Randall L. Schultz and Dennis P. Slevin, IMPLEMENTATION AND ORGANIZATIONAL VALIDITY: AN EMPIRICAL INVESTIGATION.

437 John S. Hughes, OPTIMAL AUDIT PLANNING - PART I.

438 Howard L. Fromkin, THE PSYCHOLOGY OF UNIQUENESS: AVOIDANCE OF SIMILARITY AND SEEKING OF DIFFERENTNESS.

439 John A. McCann, Jeffrey G. Miller and Herbert Moskowitz, MODELING AND TESTING DYNAMIC MULTIVARIATE DECISION PROCESSES.

440 David A. Zellinger, Howard L. Fromkin, Donald E. Speller and Carol A. Kohn, A COMMODITY THEORY ANALAYSIS OF THE EFFECTS OF AGE RESTRICTIONS UPON PORNOGRAPHIC MATERIALS.

441 Jeffrey G. Miller, William L. Berry and Cheng-Yi F. Lai, A COMPARISON OF ALTERNATIVE FORECASTING STRATEGIES FOR MULTI-STAGE PRODUCTION INVENTORY SYSTEMS.

442 William L. Berry and Vittal Rao, CRITICAL RATIO SCHEDULING: AN EXPERIMENTAL ANALYSIS.

443 Leonard J. Parsons and Randall L. Schultz, THE IMPACT OF ADVERTISING ON THE AGGREGATE CONSUMPTION FUNCTIONS: I. PRELIMINARY RESULTS.

444 Robert O. Edmister, NEW BANK DEPOSIT GROWTH.

445 Randall L. Schultz and Dick R. Wittink, THE MEASUREMENT OF INDUSTRY ADVERTISING EFFECTS.

446 David L. Ford, Jr. AN EXAMINATION OF STRUCTURE AND GROUP POSITION CENTRALITY IN EXPERIMENTALLY CREATED HIERARCHIES.

447 H. L. Fromkin, J. H. Goldstein and Timothy C. Brock, THE ROLE OF "IRRELEVANT" DEROGATION IN VICARIOUS AGGRESSION CATHARSIS: A FIELD EXPERIMENT.

448 David L. Ford, Jr., EFFECTS OF GROUP STRUCTURE ON MEMBER ATTITUDES AND SATISFACTIONS IN DECISION CONFERENCES.

449 Vincent A. Mabert, EVALUATING SCHEDULING DECISION RULES USING A FRACTIONAL FACTORIAL DESIGN.

450 Herbert Moskowitz and David J. Reibstein, CONDITIONAL VERSUS UN-CONDITIONAL ANALYSIS OF DYNAMIC DECISIONS.

451 Wesley H. Jones and Edgar A. Pessemier, SINGLE SUBJECT DISCRIMINANT CONFIGURATIONS: AN EXAMINATION OF RELIABILITY, VALIDITY AND JOINT-SPACE IMPLICATIONS.

452 Donald C. King and John J. Sherwood, MONITORING THE PROCESS AND EVALUATING THE RESULTS OF ORGANIZATION DEVELOPMENT.

453 Frank M. Bass and Dick R. Wittink, POOLING ISSUES AND METHODS IN REGRESSION ANALYSIS WITH EXAMPLES IN MARKETING RESEARCH.

454 Gordon K. Constable and D. Clay Whybark, THE COMBINED TRANSPORTATION AND INVENTORY POLICY DECISION.

455 Frank M. Bass, AN EMPIRICAL ANALYSIS OF THE THEORY OF STOCHASTIC PREFERENCE.

456 Herbert Moskowitz and Gary Koehler, IMPUTING PARAMETERS OF A PAYOFF FUNCTION FROM DECISION RULES ESTIMATED BY REGRESSION.

457 David L. Ford, Jr., A BEHAVIORAL-DECISION THEORETIC APPROACH FOR COMPUTERIZED MAN-JOB MATCHING SYSTEMS.

458 James C. Moore, REVEALED PREFERENCE AND OBSERVED DEMAND BEHAVIOR.

459 David L. Ford, Jr., AN INVESTIGATION OF A PARAMETRIC PROBABILITY MODEL FOR PREDICTING JOB PREFERENCES.

460 John J. Sherwood and John J. Scherer, THE DATING/MATING GAME: HOW TO PLAY WITHOUT LOSING.

461 Basheer M. Khumawala, AN EFFICIENT HEURISTIC PROCEDURE FOR THE CAPACITATED WAREHOUSE LOCATION PROBLEM.

463 Howard L. Fromkin and Ord Elliott, AN EVALUATION OF THREE YOUTH SERVICE BUREAUS: A STUDY OF INTERORGANIZATIONAL INFLUENCE.

464 Robert R. Trippi and Basheer M. Khumawala, MULTI-ASSET FINITE HORIZON INVESTMENT RENEWAL PROBLEM.

465 Vinod K. Sahney, H. Allan Knappenberger and David L. Ford., Jr., SUBJECTIVE DECISION MAKING UNDER CONFLICT OF INTEREST: A CAST STUDY.

466 Robert Van Order, THE THEORY AND CONTROL OF INFLATION: A NEW-KEYNESIAN APPROACH.

467 Frank M. Bass and Abel Jeuland, STOCHASTIC PREFERENCE THEORY: DERIVATIONS AND COMPARISONS.

468 Lawrence J. Ring, AN APPLICATION OF THE THEORY OF STOCHASTIC PREFERENCE TO BRAND SWITCHING BEHAVIOR IN THE AUTOMOBILE MARKET.